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Operations and Services
Climate Services, NWSPD 10-10

CLIMATE MEANS

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SUMMARY OF REVISIONS: Supersedes Weather Service Operations Manual (WSOM) Chapter F-51, "Normals," Issuance 83-6, dated April 8, 1983

signed September 30, 2002
Gregory A. Mandt Date
Director, Office of Climate,
Water, and Weather Services

Table of Contents: Page

1. Introduction. This instructional directive describes the 30-year climate means used as reference for NWS observing stations and climate outlooks. The National Environmental Satellite Data and Information Service's National Climatic Data Center (NCDC) provides means for NWS observing station data. The NWS Climate Prediction Center (CPC) provides means as reference in their climate outlooks.

2. Definitions. The definitions are consistent with World Meteorological Organization (WMO) terminology.

2.1 Period Mean. A period mean is a mean computed for any period of at least 10 years starting on January 1 of a year ending with the digit 1. One such period is January 1, 1991 through December 31, 2000.

2.2. Normal. A normal is a period mean computed by NCDC for an NWS observing station from a period comprising three consecutive 10-year periods (for example, 1971-2000). For cases of sensor instrumentation change and/or relocation, NCDC will make appropriate adjustments to the observational record for the observing station. See section 3.3.3 for details.

2.3 Base Period Mean. CPC computes base period means for climate outlook divisional areas and selected observing stations from a period comprising of three consecutive 10-year periods. CPC will use three consecutive 10-year periods ending in a decadal year (e.g. 1971-2000).

2.4 Outlook Class Limits. CPC provides the upper and lower parameter range of values for each of three climatologically equally likely classes: above, near, and below normal.

3. Observing Station Normals. NCDC provides normals for temperature, precipitation, snowfall, and heating and cooling degree days for use with NWS Automated Surface Observing Station (ASOS) sites and NWS cooperative observing stations. For ASOS sites of major interest, Weather Forecast Offices (WFO) issue the following products:

GENERIC WMO HEADING	GENERIC AWIPS ID	PRODUCT TITLE
CDAA4i CCCC	CLIXXX	CLIMATOLOGICAL REPORT (DAILY)
CXAA5i CCCC	CLMXXX	CLIMATOLOGICAL REPORT (MONTHLY)

Key for WMO Heading and Advanced Weather Interactive Processing System (AWIPS) ID;
AA = US (Contiguous U.S.), AK (Alaska), HW (Hawaii), CA (Puerto Rico),
KA (Micronesia/Palau), GM (Guam), MH (Marshall Islands)
i = area of country (1 through 9) of issuing WFO
CCCC = site ID for issuing WFO
XXX = site ID of ASOS observation station

These products are described in Procedural Instruction 10-501, "WFO Statements, Summaries, Tables Product Specification."

3.1. Official Source of Normals. NCDC issues the following publications as part of the Climatography of the United States (CLIM) series as follows:

CLIM No. 81: Monthly Normals of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000.

CLIM No. 84: Daily Normals of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000.

3.2. Effective Dates of Normals. NWS and NCDC will set the effective date for temperature, precipitation, and cooling degree day normals as January 1 following publication of the CLIM. NWS and NCDC will set the effective date for heating degree day and snowfall normals as July 1 of that same year. For the 1971-2000 normals, the effective dates were January 1, 2002 and July 1, 2002, respectively.

3.3. Calculation of Normals.

3.3.1 Monthly Normals. NCDC calculates the monthly normals using observed daily data (according to section 2.2) except for degree days at NWS cooperative observation stations, as noted below. Monthly degree day normals at NWS ASOS stations are derived from observed daily data (the same as other elements).

Notes on deriving monthly degree day normals at NWS cooperative observation stations:

- NCDC computes monthly degree day normals from estimates of monthly degree day values using a modified version of the Rational Conversion Formulae developed by H.C.S. Thom.

- NCDC uses this modified Thom technique to derive estimated monthly degree day values with a spline fit of the monthly mean temperature and standard deviations to ameliorate the month-to-month step function inherent with only a single monthly input.

3.3.2. Daily Normals. NCDC derives daily normals by interpolating from the respective monthly normals using a cubic spline function. Therefore, the daily normals do not have climatological or meteorological significance. For example, a daily precipitation normal of 0.12 inches on May 1 does not imply that the most likely precipitation amount on May 1 is 0.12 inches. WFOs use these daily normals for the calculation of daily, weekly, monthly, seasonal, yearly, month-to-date, season-to-date, and year-to-date departures from normal.

Note on daily degree day normals: In months with few heating and cooling degree days, NCDC uses an asterisk (*) to indicates values of less than 1 but greater than 0 for a given day. NCDC uses this convention to smooth the daily distribution of daily degree days in such months and to ensure compatibility of daily mean temperature and heating and cooling degree days.

3.3.3. Effect on Normals from Changes in Observing Conditions. If temperature sensors or precipitation gauges are relocated and/or replaced by new equipment, NWS will collect comparative data to be used as the basis for revising the normals. See Instruction 10-1302 (Instrument Requirements and Standards for the NWS Surface Observing Program [Land]) for further details. Revised normals become official as soon as they are distributed to the WFO for that observing site.

Note: NCDC usually adjusts the observational record for the 1971-2000 normals period to be representative of the observing conditions (instrumentation and/or location) as of the last day of the normals period (e.g. December 31, 2000). If changes in observing conditions occur, records adjustment to the last day of the normals period requires the changes to be detectable and correctable using established methods of change point detection. For instance, changes in observation conditions that occur near the end of the normals period may not lead to a detectable change or discontinuity in the observational record. In this case, NCDC would adjust the record to the observing conditions prior to that change. For example, a change in observing practices on October 15, 2000 would probably not yield a detectable discontinuity. Thus, the adjustment would be made to conform with practices on October 14, 2000 instead of December 31, 2000.

3.3.4. Normals and Observations for February 29. WFOs will handle normals and observations related to February 29 in leap years in the following manner:

- February 29 (Daily) Normals: For February 29, WFOs will use the February 28 values for temperature, precipitation, snowfall, and heating and cooling degree days.

- February Monthly Normals: No change will be made in leap years for normal temperatures, precipitation or snowfall. However, for heating and cooling degree days, WFOs will increase the February normals by the February 29 values.

- Seasonal Normals: After February 29, WFOs will not increase normal seasonal heating and cooling degree day totals, precipitation, or snowfall by the February 29 values.

- Annual Normals: There will be no change in annual temperature, precipitation, or snowfall values by the February 29 values.

- Seasonal and Annual Observed Totals: WFOs will increase the seasonal and annual precipitation and snowfall totals by the February 29 observed values. WFOs will increase seasonal heating and cooling degree days totals by the February 29 values.

Consider the following example for heating degree days (cooling degree days would be treated similarly):

For February Computations:

	NORMAL	OBSERVED	DEPARTURE FROM NORMAL
Season through January	2850	2850	0
February 1-28	+800	+700	
February 29	+ 30	+ 20	
Season through February	3680	3570	-110

For March Computations:

Remove Feb 29 Normal	- 30		
Updated through February	3650	3570	- 80
March 1-31	+600	+530	
Season through March	4250	4100	-150

Consider the following example for precipitation (snowfall would be treated similarly):

For February Computations:

	NORMAL	OBSERVED	DEPARTURE FROM NORMAL
January	3.00	3.00	0
February 1-28	2.80	2.75	-0.05
February 29	0.10	0.06	-0.04
February 1-29	2.80 (still)	2.81	+0.01
Year through February	5.80	5.81	+0.01

4. Base Period Means and Outlook Class Limits for Climate Outlooks. CPC provides this information for surface air temperature, precipitation, sea surface temperature, and 500 millibar heights as reference in their climate outlooks. The information applies to the valid times of the various outlooks. CPC and the Climate Services Division will announce the effective date of the new base period means and class limits at least 30 days in advance.

4.1 Temperature and Precipitation Base Period Means and Outlook Classes. CPC calculates this information for each of 102 areal climate outlook divisions and selected cities.

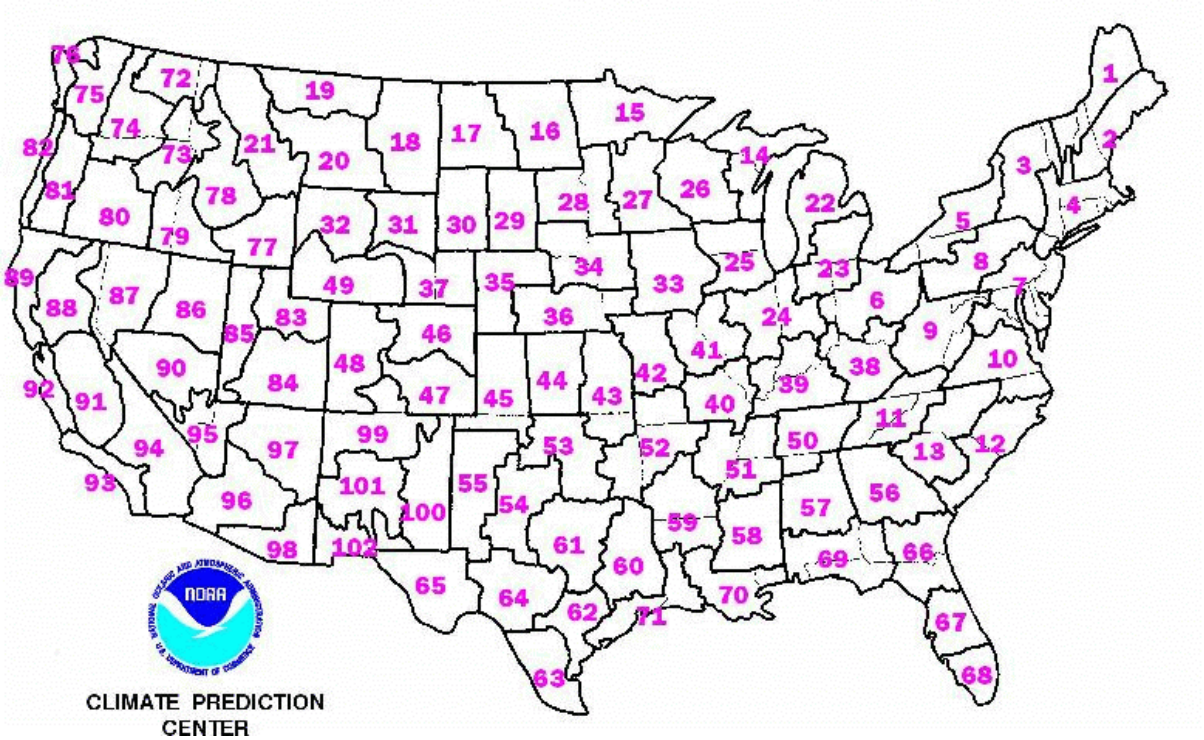

Figure 1. CPC Climate Outlook Divisions for contiguous U.S.

Base Period Means and Class Limits are calculated for the following valid times. This information is available in both graphic and text formats on CPC's web site. CPC may post just a subset of the valid time calculations for the 6- to 10-day and 8- to 14-day Outlooks (one or two valid times per month).

For Three-Month Outlooks:	For One-Month Outlooks
January through March	January
February through April	February
March through May	March
April through June	April
May through July	May
June through August	June
July through September	July
August through October	August
September through November	September
October through December	October
November through January	November
December through February	December

For 8- to 14-day Outlooks	For 6- to 10-Day Outlooks
January 1 through January 7	January 1 though January 5
January 2 through January 8	January 2 through January 6
etc.	etc.
December 31 through January 6	December 31 through January 4

Notes on 6- 10 day and 8- to 14-day base period means: CPC smooths the temperature climatologies using a harmonic analysis with three harmonics retained. CPC smooths the precipitation climatologies using 11 and 15-point running means for the 6- to 10-days and 8- to 14-day outlooks, respectively.

The following are some example of CPC base period mean maps available on their web site.

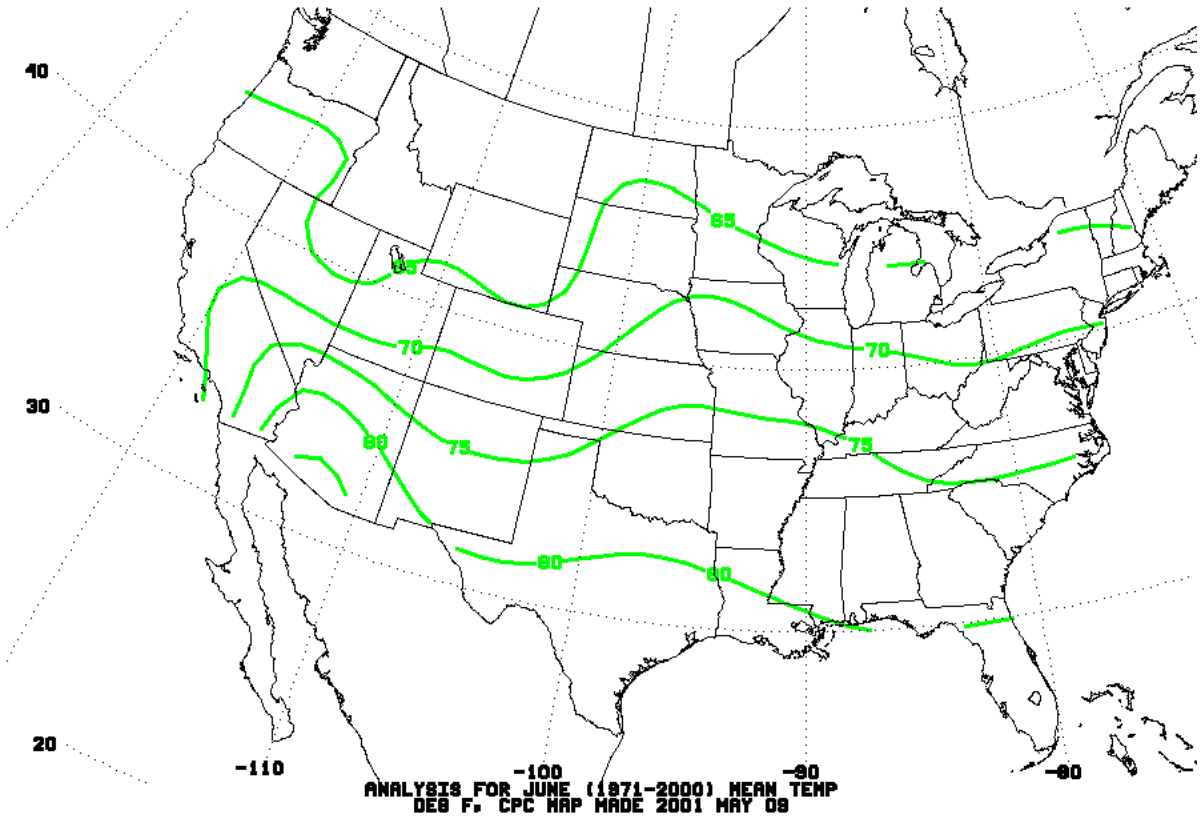

Figure 2. Map of CPC 1971-2000 base period mean temperature for June.

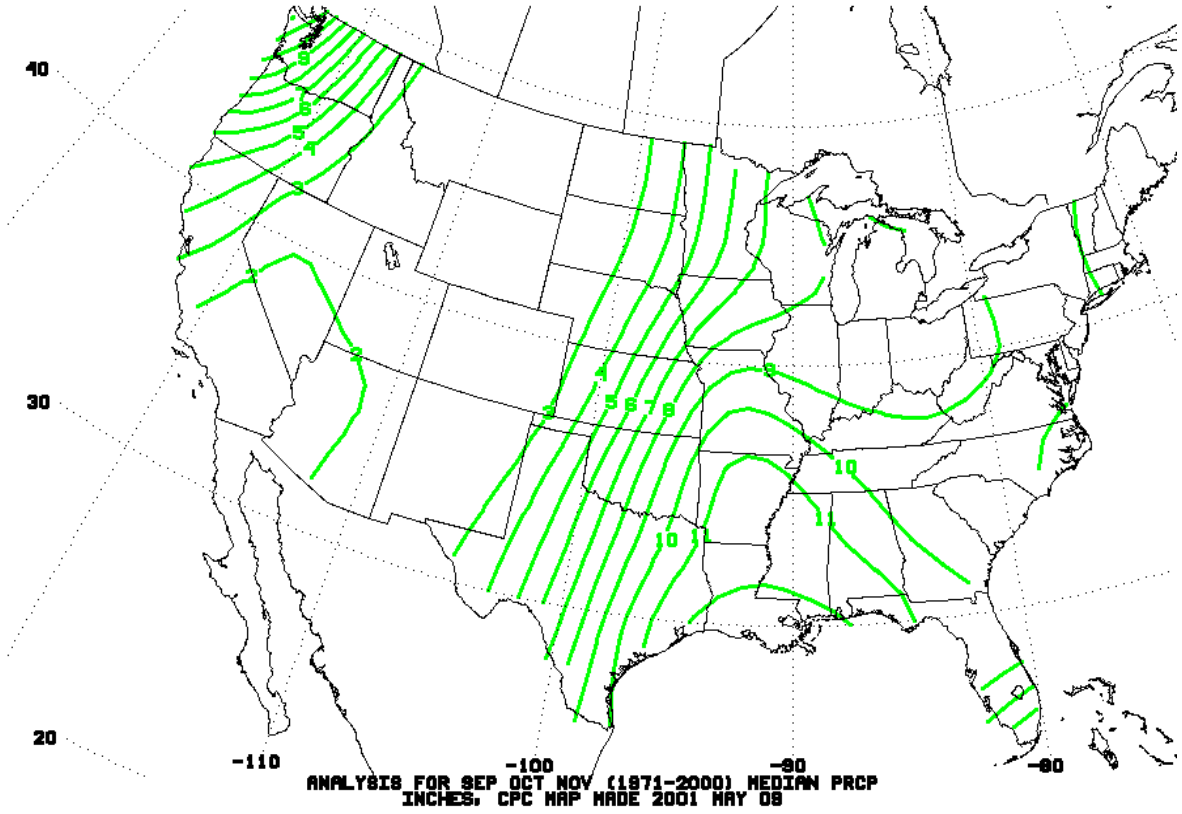

Figure 3. Map of CPC 1971-2000 base period mean total precipitation (inches) for September through November.

4.2 Base Period Means for Mean 500 millibar heights. CPC has calculated mean 500 millibar heights for the valid times listed in section 4.1. This information is available in graphic format on CPC's web site. The following is an example of base period mean 500 millibar chart.

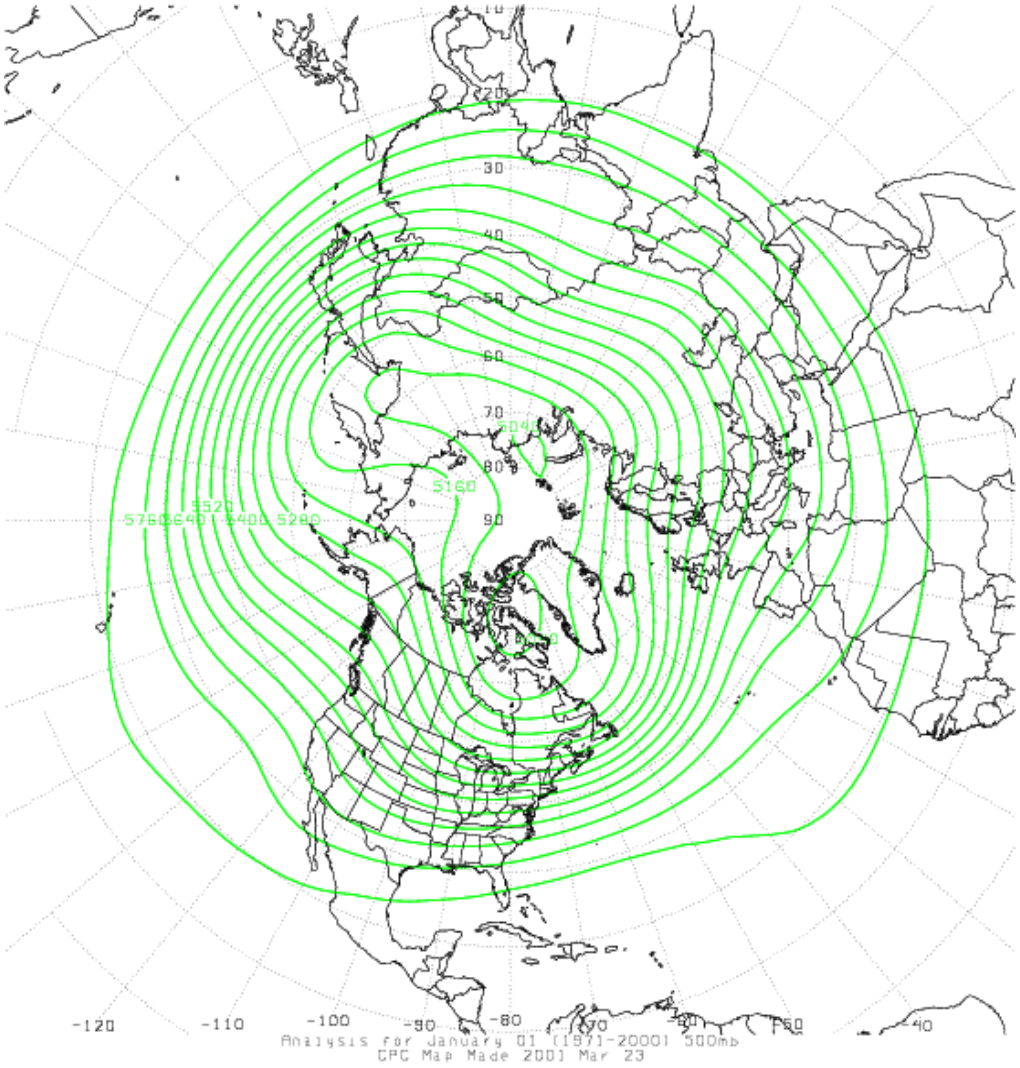

Figure 4. CPC 1971-2000 base period mean 500 millibar height chart (in decimeters) for January 1 through 5 (to be used to determine height anomalies in the 6- to 10-day 500 height outlook issued December 26).

4.3 Sea Surface Temperature (SST) Base Period Means. CPC has calculated SST means for each month as reference to the official Tropical Pacific SST Outlook (for the Pacific Niño 3.4 area [5°N to 5° S and 120° W to 170°W]). The CPC web site provides global maps of the base period SST means and charts for critical "Niño"subsections of Tropical Pacific Ocean. Since the SST outlooks are valid for three-month periods, CPC averages the base period SST means of the three months as a reference to calculate the predicted three-month anomaly.

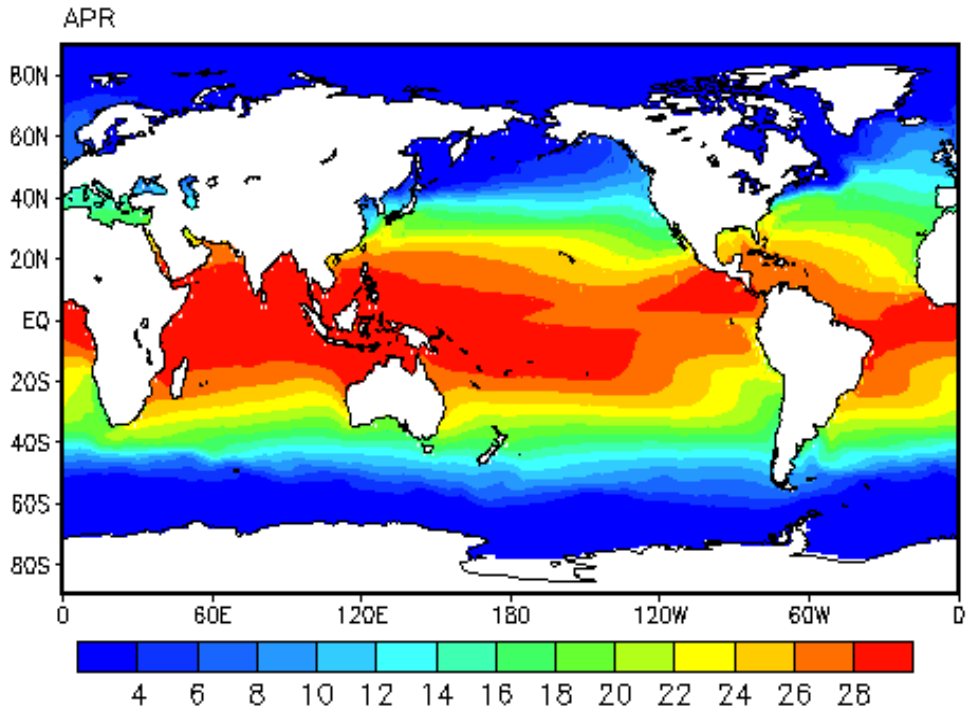

Figure 5. April 1971-2000 base period mean sea surface temperature chart. Temperatures are in Celsius.